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Teaching and Learning of Word Problems in Beginning Algebra

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NIGERIA: Where we are



- Challenges in Education: Regional gaps; large population; multi-language; basic education
- Mathematics education: Core subject; students' poor performance and negative attitude; large classes; heavy teacher workload

Beginning Algebra

- Algebra: 'Gateway' and 'Language' of higher mathematics (Kieran, 1992; Fearnley-Sanders, 2000)
- Introductory aspects: Variables ; Expressions; Equality; Functions ; Graphs
- Difficulty in transition from arithmetic (Goldin,2008; Herscovics & Linchevski, 1994)
- Misconceptions & Errors (Clement,1982; Stacey & Macgregor,1997; Reed,1999)
- Word problems: Mathematical & text language, and mathematics (Newman, 1983; Pimm,1991)

$$2, 14, 3+2=5, 7 \times 3=, 38-12$$

$$3+y=5, x=1, 2a+b, 5x, a=4$$

Beginning Algebra

- **Algebra misconceptions**
 - Letter, especially as a word or object
 - Confusing products and sums
 - Equality
- **Newman language-based error analysis**
 - Read aloud the question
 - Understand specific terms and general meaning
 - Transform words to suitable representation
 - Process representation mathematically
 - Write the answer

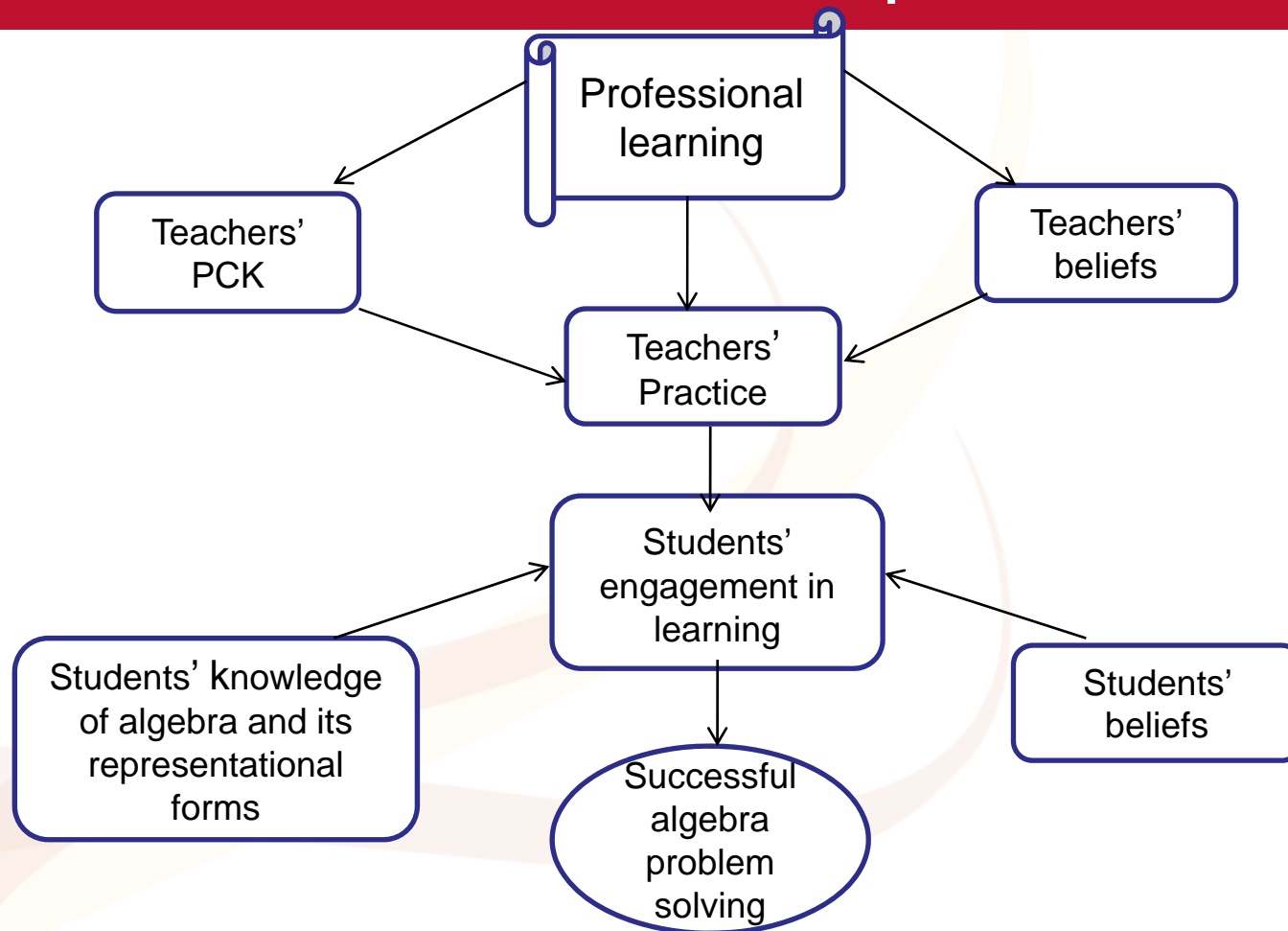
Purpose and Research Questions

- The study describes how word problems are taught in beginning algebra and the difficulties experienced by Year 7 students. It also examines the impact of a teacher professional learning intervention on classroom practices and students' success in solving algebraic word problems.
1. How are word problems in Year 7 Beginning Algebra class taught in public schools?
 2. What difficulties do students in Year 7 experience in solving beginning algebraic word problems and are they different from difficulties teachers perceive students would have?
 3. How does a teacher professional learning intervention programme impact on Year 7 classroom teachers' beliefs, knowledge and practice?
 4. How does the teacher professional learning intervention programme impact on students' difficulties and success in solving algebraic word problems?

Significance

- New knowledge about the adaptation of Newman procedure for general use in classroom.
- Identification of language process errors in solving algebraic problems in a West African country - Nigeria.
- Filling the gap of limited literature about professional learning focused on teacher's knowledge of students' thinking and misconceptions in beginning algebra.
- Findings will inform stakeholders for a better preparation of pre-service mathematics teachers and provide a platform for teacher professional learning.

Conceptual Framework



Stages of data collection

Pre intervention

- Pilot study
- General survey (n=30)
- 4 Case Studies: Observations, Pre-test, Interviews

Professional
learning
Intervention
program

- Rating of students' algebra questions (n=12)
- Students' beginning algebra misconceptions
- Language-based approaches

Post intervention

- 4 case studies: Observations, Post-test, Interviews
- Focus group interview, debriefing session (n=12)

Initial Findings: Professional learning

Rating of algebra questions	Mathematics-Algebra	Language –based approaches
All symbolic questions were rated easier than word problems and the most difficult symbolic questions were equations with inverse	Most teachers had wrong solutions to the two word problems resulting from misconceptions about the letter and reversal error	Newman language-process error analysis procedure reported to be the most successful approach
The most difficult word problem involved only knowledge of the letter as a quantity	Unaware of some misconceptions initially but during PL, they corrected their errors on the word problems	Use of simple language, familiar words and revoicing were other reported successful approaches
Word problems with two variables were mainly rated as adequate	Students' difficulty perceived to mainly relate to their inability to interpret the word problem	Use of group-work and wait time were difficult due to class size

Thank you for listening